Gold in the News

Recent news from the world of gold science and technology

Start-up Company With Gold Cancer Treatment

A recent report from the on-line news source for those in the nanotechnology field, *Smalltimes*, described the basis of a new technology start-up company, Nanospectra Biosciences, based in Houston, USA. The company's approach is to inject spherical nanoshells of gold and silica into the patient with cancer. The shells circulate through the body until they naturally pile up near tumour cells. Doctors are then able to use an infrared laser to heat the shells and kill the tumour tissue. The Nanospectra technology specifically targets micrometastases, the tiny enclaves of cancer cells too small for surgeons to find and remove with a scapel. The advantage over current treatments such as chemotherapy is that the technology seems to kill tumour cells without any accidental damage to nearby healthy cells. Nanospectra is reported to be at least 18 months from human trials and so treatments will not be available until at least 2006. Read more on this story at: http://www.smalltimes.com/document_display.cfm?document_id=5867

Gold on Titania Reference Catalyst Available

World Gold Council has announced that three of the four types of Gold Reference Catalysts it plans to distribute are now available to researchers. The latest samples that can be obtained from the Council are based on Au/TiO_2. Details on how to order samples can be accessed from the Councils website at: http://www.gold.org/discover/sci_indu/gold_catalysts/refcat.html

Gold in Cheaper Solar Panels?

According to the April 2003 issue of *re-gen* magazine, researchers in the US have developed a new type of photovoltaic device, with the significant advantage that silicon would not be required in its production. This approach could save significant costs over current technology. The multi-layered structure consists of photoreceptor molecules resting on a film of gold and a titanium dioxide semiconductor. Conventional solar cells rely on silicon semi-conductors both to absorb light energy and to collect the resulting charge. The new device, however, separates these functions. Light energy absorbed by the photoreceptor causes electrons to pass through the 10-50 nm layer of gold. This is then collected by the titanium dioxide semiconductor layer underneath. Work is needed to increase current overall efficiency from a modest 1%.

Gold could cut utility mercury emissions

Delegates at a United Nations environmental conference in Nairobi, Kenya, recently endorsed a global clampdown on mercury-caused pollution. Studies have shown that exposure to mercury, the highly toxic heavy metal, may be linked to Alzheimer's disease and autism. Mercury is discharged in smokestack emissions, particularly from coal fired utility power stations and in the United States, the coal-fired utility industry expects the Environmental Protection Agency (EPA) to announce mercury regulations for their boilers in 2004. As a result, various techniques to control mercury emissions are currently being investigated in a number of research centres around the world. Mercury is difficult to control because it is present in the flue gas as a vapour (either in the elemental or ionic form) rather than as particulate matter like other metals. Now research at Illinois Institute of Technology has highlighted a potential technology for mercury control using gold. Utilities currently use carbon as one way to reduce mercury in their emissions, but carbon's absorption capacity is inefficient, and carbon particulates are carried away with the emissions. Professor Khalili at the Institute has found a way to modify carbon's structure so that it can be coated with a thin layer of gold. The research team has applied for a patent on the process. The gold in effect acts as an absorbant which can be recycled and the trapped mercury re-used for industrial purposes. Cost savings could be significant because the process uses less than one-third of the carbon, by weight, of

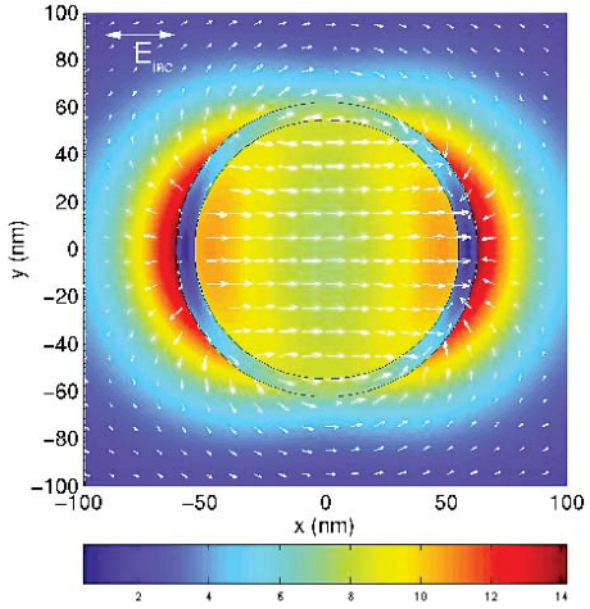
today's mercury-removal methods. The gold is plated in a thin layer, so its cost should not be prohibitive.

New Use for Gold Rings

Scientists from NIST in the US have demonstrated that when a gold ring has a radius of about 60 nanometers, it acquires special properties that could make it a useful container for nanoscale experiments, thereby providing unusually clear results. Such experiments would be of interest to the drug industry and biochemical researchers, among others. Gold nanorings have unique optical and electromagnetic properties that can be "tuned" by varying the ratio of the ring radius and wall thickness. When light is directed at the ring, it excites the electrons in the metal and creates a wave that oscillates in certain ways depending on the wavelength of light and ring geometry. The NIST team determined how to synchronize the energy of the incoming light and the pool of electrons, so that they "resonate" on the same wavelength. This resonance creates a strong and uniform electromagnetic field that oscillates inside the ring cavity. The figure depicts the field within and around a ring with a radius of 60 nm and a wall thickness of 10 nm. The colours indicate the field strength, ranging from blue (weak) to green and yellow (strong and uniform) to red (very strong). The arrows indicate the direction of the field created by the pool of excited electrons. The field inside a ring with these dimensions is optimized for the near-infrared part of the electromagnetic spectrum. The ring cavity could therefore be a useful container for experiments in which molecules are tested with light, because it would amplify infrared signals. For example, researchers study the chemical bonds in biomolecules like proteins by probing them with lasers and detecting how much of the light is absorbed and re-emitted at specific frequencies. By conducting such experiments inside a nanoring, researchers could obtain amplified infrared signals and clearer results. For further information see http://www.nist.gov

Stretching Gold Connectors

Researchers from Princeton University have developed a type of conductor that is stretchable. It is claimed that the flexible conductor promises better connections for devices that attach to flexible surfaces like skin or that span oddly shaped spaces. The conductor is a sandwich of a type of plastic, a 5-nanometer-thick layer of chromium, and a 25- to 100-nanometer layer of gold. According to the work



reported in Applied Physics Letters, the process of depositing the gold caused the layer to form a pattern of wrinkles that smooth out when the conductor is stretched. The film continues to conduct electricity when stretched as much as 22 percent, according to the researchers. In contrast, gold strips can crack when they are stretched one or two percent. The conductors could improve retina-shaped photosensor arrays, plastic actuators, and stretchable sensitive skin for machines, according to the researchers. Read more at www.trnmag.com

Gold Nanoparticles and DNA

Scientists at the University of Illinois at Urbana-Champaign have developed a highly sensitive and selective biosensor. According to a paper that has been accepted for publication in the Journal of the American Chemical Society, the colorimetric sensor is based upon DNA-gold nanoparticle chemistry, and could be used for sensing a variety of environmental contaminants, such as lead.

Using gold nanoparticles laced with DNA, Illinois chemistry professor Yi Lu and his team were able to hybridize the nanoparticles into aggregate clusters that had a characteristic blue colour. In the presence of a specific metal ion, the catalytic DNA breaks off individual gold nanoparticles, resulting in a dramatic colour shift to red. The intensity of the colour depends upon the initial concentration of contaminant metal ions. In addition to lead, the process could detect other metal ions, such as mercury, cadmium and zinc. Read more at www.eurekalert.org